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THE MEASURED EFFECTS
OF
CERTAIN THERAPEUTIC AGENTS,
AMONG WHICH ESPECIALLY ARE
LAVAGE, HCl, AND INTRAGASTRIC ELECTRICITY,
UPON THE SECRETORY AND MOTOR FUNCTIONS OF THE
STOMACH IN CASES OF CHRONIC CATARRH
(GLANDULAR GASTRITIS).

*Read before the Section of Therapeutics, Pan-American Congress,
at Washington, September, 1893.*

BY

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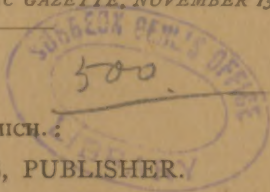
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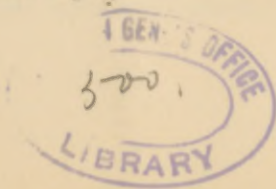
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The Measured Effects of Certain Therapeutic Agents, among which Especially are Lavage, HCl, and Intra-gastric Electricity,
UPON THE SECRETORY AND MOTOR FUNCTIONS
OF THE STOMACH IN CASES OF CHRONIC
CATARRH (GLANDULAR GASTRITIS).

IN selecting a subject suitable for a paper for this Section of the Congress, on consideration none appeared more apt than that devoted to a *résumé* of the results obtained in several cases of chronic gastric catarrh by modern methods of treatment. Though a theme perhaps uninviting to many whose special work lies in other fields, and who, fortunately for themselves, have also yet little personal need for knowledge as to the recent advances in the treatment of gastric affections, it is, nevertheless, a topic of high importance in view of the fact that the majority of cases of stomach disorder encountered are of the nature of chronic catarrh. These form the greater number of cases that the general practitioner is called upon to treat of so-called chronic indigestion, gastric and flatulent dyspepsia, and the like,—symptomatic terms, only significant in their convenient cover for professional ignorance and as assuagers of too inquisitive clientele inquiry.



Elsewhere,* but recently, I reviewed in somewhat elaborate detail the general therapeutics of the various forms of gastritis. A repetition, therefore, would be unnecessary, even though it here were an applied therapy and space permitted it. I have now rather considered less the general than the special treatment, and that by a few important remedies concerning the utility and *modus operandi* of which in certain directions there is still some debate. These are especially lavage, hydrochloric acid, and intragastric electricity. The effects of these have been particularly studied on the secretory and motor gastric functions. In the application of these medicaments certain facts of importance in the therapy of chronic gastric catarrh are developed, especially as to the great utility of combined intragastric galvanism and faradism as a secretory stimulant after failure of other remedies. Conclusions reached in the three cases are in their most important particulars supported by similar observations in a number of other cases in which the partial or complete treatment here outlined was also pursued. Thus, deductions here cited, though drawn from limited data, may be accepted to apply to a larger number of a similar class of cases.

CASE I.—Mrs. C. F., aged fifty-seven. For several years, prior to which digestion and general health have been good, there have been present dyspeptic symptoms, especially aggravated in the past two years, probably through overtaxing physical energy in the conduction of a tailoring business. She never had espe-

* "System of Therapeutics," edited by Hare, vol. ii.

cially abused stomach. No alcoholic addiction. Her symptoms when first seen in May, 1892, were nausea, anorexia, and epigastric sensations of burning and weight succeeding all food, flatulency, constipation, coated tongue, occasional vomiting after eating, loss of weight (twenty pounds in two years), sallow skin, constant slight headache, very irregular, intermittent, weak heart, without enlargement, somewhat prominent temporals, but vessels nowhere noticeably fibroid. She was confined to the house and often to bed, sinking spells occurring at short intervals. The outline of liver dulness was somewhat increased; stomach was slightly dilated; urine was normal in amount; no albumin; urea excretion normal. Under carefully-regulated, though nutritious, diet, the employment of laxatives, and the free use of HCl and of strychnine after meals, some subjective improvement occurred. The heart became absolutely regular under digitalis in *full* doses, but the latter much aggravated gastric symptoms, so could not be long continued. Strophanthus, increased to its maximum dose, formed but a poor substitute. Cactus grandiflorus, however, in doses of forty drops of the fluid extract, admirably replaced it; but though irregularity ceased without these as she became stronger, intermittency, in the shape of an imperfect systole every third to fourth pulsation, was constant when digitalis or cactus was withheld. Nitro-glycerin was taken for a time; this increasing headache, could not be continued.

Employment of the stomach-tube for diagnostic purposes and for lavage, previously ob-

jected to, was begun after she had been under observation five months, HCl after meals having been taken quite steadily. Examination of the stomach contents, first made then, showed: absent HCl; pepsin and lab-ferment present; albumoses in but small amount; no peptone; erythrodextrin present; no starch; digestion test negative without addition of HCl to filtrate; lactic acid in large amount; acid salts likewise excessive; much mucus in wash-water.

Daily lavage was begun October, 1892, the water in the first few weeks being medicated with sodium sulphate, bicarbonate, and chloride. Lavage has been continued to the present, with, lately, intermissions of a few days. HCl after meals was also continued quite regularly until intragastric electricity was begun in the ensuing January. A pancreatic preparation before meals was also taken occasionally. Three weeks after beginning lavage, other medication continuing as before, save that cannabis indica and strontium bromide were used for a time for certain local and general nervous symptoms, free HCl was detected in the stomach contents, with a diminution in the quantity of lactic acid and a heightening in the total acidity. From that time to the present, with a single exception,—three weeks after the examination noted above,—free HCl has invariably been found in all examinations. These have been made regularly at frequent intervals to the present. Intragastric electricity was applied daily from January 14 to April 19, in the manner detailed in another part of this paper.

Improvement was striking in all symptoms

under lavage, cardiac irregularity ceasing entirely soon after it was begun. No cardiac medicaments have been prescribed since.* Free HCl, which had been absent from the stomach notwithstanding a two months' course of this acid, appeared during the third week of lavage. It was not detected in any save a very low percentage until intragastric electricity had been used for three weeks. The increase was then so decided as to leave slight doubt as to its cause. At the expiration of nine weeks' daily employment of electricity, the percentage of free HCl was practically normal.

The wash-water was nearly always turbid with mucus in the early period of treatment by lavage; as improvement in general condition occurred, mucus was less and less present. Now little or none is noticed, save coincident with exacerbations of attacks of acute indigestion. Muscular strength has largely returned. The general improvement in her condition since lavage and electricity were begun seems quite remarkable. Headache lessened under lavage, but did not disappear until the third week of the use of intragastric electricity. The bowels have been very regular, no laxatives being

* Intermittence has returned on two occasions since, the last time early in June, an imperfect systole occurring with every fourth to tenth cardiac revolution. A return is coincident with temporary aggravation of the gastric symptoms. The cardiac tone has markedly improved. The first sound is normal; the second somewhat accentuated at apex. Pulse-tension is now always raised. This, not readily detectable by the finger, is shown by the sphygmograph. A rather highly nitrogenous dietary and comparatively little exercise is probably a factor in the maintenance of the high tension. There are no indications of renal degeneration.

required. Occasionally, however, a calomel purge is given. Appetite, at first poor, soon became good. She is now constantly hungry, though getting four light meals daily.

The propulsive power of the stomach was at first much impaired, tested both by Ewald's method and by that which I prefer,—Leube's. In the early part of the treatment salol response was much delayed, and the larger part of a moderate dinner could be removed by lavage seven hours after its ingestion. Salicyluric response, when last tested, a few months ago, appeared in three-quarters of an hour to an hour, and traces of food in the wash-water are now rarely, if ever, noted at the expiration of six hours after a moderate dinner.

The next case is especially of interest in that a study was made of the effects of various methods of treatment on gastric secretory activity, here almost entirely in abeyance until electricity was tried.

CASE II.—Mrs. M. M., aged thirty-five years. Symptoms of pronounced indigestion of four years' duration. Ailment existing in severe form when case was seen in January, 1893. There were then present discomfort after food, constant flatulence, with noisy, almost continuous eructations of bad-smelling gases and partially-digested, ill-tasting food. Discomfort after eating often amounted to pronounced distress, relieved only by vomiting. She usually vomited after eating, if any save the lightest food was taken. Asserts that she has lost, by actual measurement, in the four years in which she has ailed, between forty and fifty pounds in flesh. Loss in weight seemed evidently largely due to the extremely abstemious

diet taken. The bowels were obstinately constipated, not moving without the use of harsh purgatives. Blood has never been vomited. There was no cachexia. Diffuse slight epigastric tenderness existed, but no tumor. The stomach was dilated, the lower level, when partly distended with a pint of water, reaching several inches below the level of the umbilicus.

Several examinations of the gastric contents were made when she first came under observation, before treatment was begun. These showed, at a time when gastric digestion should be at its height, total acidity, 25 to 30, due solely to organic acids and acid salts. HCl was absent from the gastric secretion. No response to Günzberg's test could be obtained until several c.c. of $\frac{N}{10}$ HCl were added to 10 c.c. of gastric filtrate.*

In addition to carefully-regulated diet and systematic daily stomach-washing, the early treatment consisted of, at first, for ten days, 5 grains of beta-naphthol and $\frac{1}{20}$ grain of strychnine sulphate three times daily. No improvement. Then, for three weeks, dilute HCl in 15- to 20-drop doses, repeated three to five times, at intervals of from ten to fifteen minutes after meals, the strychnine also being continued. No improvement. Symptoms as annoying as before. Five grains of an active

* Usually 2 c.c. to 10 c.c., or 20 c.c. to 100 c.c., of filtrate, showing absent bound HCl. I use this method as a very convenient gauge of the relative amount of *bound* HCl present in stomach examinations in which no response to free HCl is obtained by Günzberg's solution.

preparation of pepsin were now added to the dose of acid; the strychnine was discontinued; some subjective improvement; vomiting ceased; eructations and epigastric sensations of weight succeeding meals were less; she ate better. All drugs now discontinued for four days. Stomach examination then made (March 7, 1893). One hour after Ewald's trial breakfast, tube in twenty-three and a half inches before outflow readily occurred; 120 c.c. imperfectly macerated roll removed.* Total acidity = 50; free HCl = 0.01 per cent.; lactic acid moderate, acid salts in excess.

The use of pepsin and acid were again resumed. After one week distinct improvement which had been felt under this combination was not maintained. All treatment save lavage and carefully-regulated diet then withdrawn.

March 20.—One hour after Ewald's trial meal 180 c.c. imperfectly-solved roll removed. Total acidity = 25 = organic acids and acid salts. Absent HCl (no response to Günzberg's test until 2 c.c. $\frac{N}{10}$ HCl added to 10 c.c. of filtrate). Digestion test made, but record of result lost.

Pepsin and acid in doses similar to those

* The method employed for the removal of the stomach contents in these cases admits of a larger quantity being withdrawn than by the expression method of Ewald. The latter averages about 40 c.c., the former about double this. In this case 120 c.c. (with 270 c.c. (3ix) of fluid taken) indicates both diminished absorption and propulsion. The method employed for removal of the stomach contents in all these cases is that described in my paper, "A Résumé of some Modern Methods of Diagnosis and Treatment of Diseases of the Stomach." —*Medical News*, February 18, 1893.

above recorded again prescribed. Improvement in symptoms of indigestion.

April 5.—Stomach examination made. Result practically similar to that immediately preceding. Pepsin now withdrawn and HCl alone prescribed, but in larger doses than before used. Symptoms of indigestion immediately recurred in aggravated form, such as nausea, eructations, and distress after eating. HCl now withdrawn, and 5 grains of pepsin, without acid, ordered, to be taken after meals for five days; food as before, moderate in amount, but largely albuminoid. No improvement. HCl and pepsin in combination re-begun. Symptoms ameliorated somewhat, but she could eat little because of distress produced by a moderate-sized meal.

April 16.—Pepsin and acid stopped; 6 grains each of papoid and beta-naphthol after meals ordered. Subjective improvement prompt, decided, and continuous, far more marked than on any previous treatment. After a few days symptoms of indigestion had almost entirely ceased. She ate better and slept well. Papoid continued for one month. Stomach examination, made at end of the second week and again on discontinuing the papoid, showed no change in secretory function, notwithstanding undoubted amelioration in subjective symptoms. All medication was now stopped, save the use of laxatives. The latter, which had been required from the first, were still necessary, lavage and the drugs used other than aperients not affecting the obstinate constipation, which was evidently due to marked atony of stomach and bowel. In a few days after discontinuing papoid, symptoms of indigestion recurred. On May 20, after an examination of

the stomach contents showing same conditions as formerly, intragastric electricity was begun and continued daily for six weeks; no drugs, save for about three weeks of this period a nightly dose of aloin, were now taken. Amelioration in all symptoms was noticeable from the first. Improvement was steadily progressive, and at the expiration of the fourth week the bowels were acting naturally, and little or no discomfort was felt after meals. Appetite was good and she ate heartily. Contrary to my desire, she ceased coming for treatment at the end of six weeks, because of practical disappearance of symptoms. Stomach examination was not again made until she was especially summoned for this purpose two weeks after the final application of electricity. There were then, one hour after the trial meal, free HCl present (percentage not calculated); lactic acid and acid salts in traces; total acidity = 30; lab test prompt and decided; digestion test not made; amount removed 60 c.c., well solved. Lower part of stomach was twenty and a half inches from incisors, instead of twenty-four inches, as formerly.

Stomach examinations were repeated a few days subsequently,—on July 23, 25, 26, and 27. On the 23d Javorski's test for the relative amount of pepsin secreted was made; 200 c.c. $\frac{N}{10}$ HCl* were introduced into the empty, cleaned stomach, and the amount remaining at the expiration of a half-hour (80 c.c.) was removed. Acidity, 57 = 0.2 per cent. HCl.

* $\frac{N}{10}$ HCl = 0.364 per cent. of *absolute* HCl.

To a number of 10 c.c. tubes, containing small disks of coagulated egg albumin of equal size, varying proportions of the filtrate from the 80 c.c. were added, $\frac{N}{10}$ HCl being used as a diluent. In the undiluted filtrate egg disk was digested in less than four hours; diluted one-half, the disk dissolved in four and a half hours. With a number of other dilutions down to 0.6 c.c. of the filtrate the disks had disappeared in all the tubes when inspected nine hours after placing them in incubator. These tests showed active pepsin secretion.

July 25.—Dinner at noon. Stomach washed at 5.30 P.M.; no trace of food in stomach. Ewald's trial meal now taken (for the first time in the afternoon); 45 c.c. well-solved roll removed; total acidity = 60; free HCl = 0.12 per cent. Lactic acid and acid salts present. Digestion test *positive in three hours.*

July 26.—Ewald's trial meal taken same time as on previous day, after washing the stomach; 50 c.c. well-solved roll removed; total acidity = 50; free HCl, 0.05 per cent. Digestive test, egg disk dissolved within four hours.

Impairment of the motor function of the stomach, permitting stagnation of ingesta, had been a prominent symptom. Seven hours after even a moderate meal the wash-water always contained much food. Improvement in the propulsive power of the stomach under electricity was manifest early. During the latter part of the period of treatment, the stomach, cleaned by aid of the tube each afternoon immediately prior to the electrical application, was found to be invariably emptied in from five to six hours after the noon dinner. The same

was the case, with sustained improvement in other symptoms, when stomach-washing was practised on the three afternoons when the above-mentioned test meals were taken and Javorski's test tried.

CASE III.—Miss M. A., aged thirty years. For a number of years during autumn and winter she has had eczema of hands and face. Was consulted for this in November, 1891. Appropriate remedies entirely dissipated the rash, which, however, showed annoying tendency to return. During a bad outbreak of eczema in November, 1892, symptoms of indigestion, from which she had long suffered, became prominent. There were sensations of fulness and weight in the epigastrium; headache immediately after meals and continuing for several hours; flatulency, with eructations of sour, bitter fluid; constipation. They were quite unyielding to such remedies as *nux vomica*, laxatives, and HCl. For this reason, lavage, preceded by an examination of the stomach contents, was begun. In the first examination, total acidity = 10 = lactic acid and acid salts; free HCl absent. HCl had been taken for three weeks prior to this and to the beginning of stomach-washing.

Very large quantities of thick mucus were always present in the wash-water at first. Recently, though the first few funnelfuls are never free from mucus, it is present now in much less quantity. For a time a mixture of sodium chloride and bicarbonate, as in the other cases, was used to favor the solution and expulsion of mucus. During the first two or three months of lavage, though tolerance to the tube was early established and no retching caused by its

introduction, bile in considerable amount was a common constituent of the water removed. As her general condition improved this was less often present, and finally ceased to appear. HCl after meals has been employed for more or less lengthy periods since lavage was begun. At first it was taken steadily for three weeks, then discontinued for a short time, and subsequently rebegun and continued until April 23 last, when it was again stopped on starting with the intragastric application of electricity. Under lavage, subjective improvement was decided from the outset, and with it, HCl, which previously had not seemed of marked avail for its immediate effect, was now of decided benefit. Sensations of weight in the epigastrium, nausea, and other symptoms indicating imperfect gastric digestion, occurring immediately after food, were promptly relieved by it. These continuing after lavage was begun, were now readily controlled by this acid. The bowels also soon became regular without laxatives, which since **have not been required.**

Two weeks succeeding the first stomach examination free HCl was present in quantity (amount not estimated) to give a moderate response to Glünzberg's solution and to Congo-paper. It has not since been absent in any of the frequent examinations made. Under all forms of treatment, however, after improvement had begun, though the total acidity has averaged about 30, the percentage of free HCl has never exceeded 0.09. For a long time it averaged but 0.03. During the past six months the usual per cent. has been 0.07. Despite this low percentage, gastric symptoms, which had disappeared under the use of HCl and lavage,

did not recur for some time after the discontinuance of the former. Intra-gastric electricity was used daily for two and one-third months, all treatment save lavage being then temporarily discontinued.

Atonic gastrectasis was present when the case first came under observation. The lower level of the stomach extended somewhere below the umbilicus, and the tube for complete removal of the stomach contents required to be introduced twenty-four inches. Dilatation in this case was distinguished from gastroptosis by the employment of Einhorn's gastrodia-phane, which very prettily transilluminated the entire gastric cavity on distending the viscus with 2000 c.c. of water. The lower level is now somewhat above the umbilicus, and the stomach is readily completely emptied with the tube in twenty and a half inches. In this case, like the former, the gastric peristole was much affected, more than seven hours being required to dispose of a light dinner. The average period of gastric digestion is now five and a half to six hours, which improvement has been more especially manifest under intra-gastric electricity than under the use of HCl or stomach-washing alone.

The beneficial effects of intelligently-applied lavage upon the disordered gastric functions in diseases of the stomach are so well known that the results obtained in these cases of chronic catarrhal gastritis may be stated without other comment than that, though improvement was apparent from its employment in all, less occurred in Cases II. and III. than was anticipated from the nature of the ailment, so amena-

ble in Case II. in many of its chief symptoms to electricity. In Case I. it is interesting to note that improvement was not manifest under a most careful regimen and suitable drugs, such as HCl, strychnine, and the like, until washing the stomach was systematically practised. Under the last, amendment was far more decided than it had previously been, and the appearance in the gastric secretion of free HCl was directly attributed to lavage. Its utility as a secretory stimulant, though more marked in this case when compared with the previous trial of HCl, was less noticeable than that obtained by the use of intragastric electricity. Lavage was without effect on the secretory function in Case II., HCl remaining absent after its long-continued employment until electricity was used for some time.

Marked subjective improvement under lavage occurred in Case III., and free HCl, which was apparently absent from the stomach when washing was started, appeared in the gastric secretion in a few weeks of its steady employment. HCl and nux vomica, both often of some utility as stimulants of gastric secretion, had been previously taken without effect. These were continued for a time, but the benefit accruing, from the mode of its appearance, was undoubtedly due chiefly to lavage. The improvement, however, in gastric secretion, as shown by the amount of increase in free HCl, was unfortunately of no marked degree under this or what proved in the others a more promising method of treatment.

The beneficial influence of lavage upon the motor function of the stomach, impaired in all, was quite decided in two, as is noted in the re-

cital of the histories. In these two cases, under its use, the stomach emptied itself in a shorter time than had been customary, and the bowels became regular without laxatives. Lavage was without effect upon the gastric peristole in Case II., in which marked atony with gastrectasis existed. Obstinate constipation with delayed gastric propulsion continued, despite the daily employment of stomach-washing for a number of months and the coincident use of HCl. Subsequently, intragastric electricity regulated the peristole and re-established secretion.

The effects of the administration of HCl in these cases, as a secretory stimulant and as a digestant, is of no little interest. Recently* I reviewed at some length the various indications for the employment of HCl in gastric ailments associated with lowered acidity. I demonstrated that the use of this acid, contrary to the view held by many, may be of immediate utility acting as a digestant, though of no service in similar cases administered for a more remote effect,—that of re-establishing its own secretion.† In the first of the present cases, twenty minims to a drachm of the dilute acid were taken in divided doses after meals for

* See "A Consideration of some Modern Therapeutic Agents in the Treatment of Diseases of the Stomach."—*THERAPEUTIC GAZETTE*, February, 1893.

† This latter I barely touched upon, and the observations as to the former, though the results were conclusive, were only preliminary. In a paper in preparation—"On the Rational Employment of HCl in Certain Gastric Affections"—the whole subject will be fully considered from a practical experimental stand-point, and various modes of administering HCl, with their effect upon the secretory function and upon digestion, will be examined.

about two and a half months, wholly without effect upon its own secretion, free HCl remaining absent from the stomach in all tests made at the time in which gastric digestion is normally at its height. In Case II., HCl was taken intermittently for a longer period in much larger quantity, both alone and combined with pepsin. Free HCl, however, remained persistently absent, except on a solitary occasion, when a fleeting response occurred to tests for it, until electricity was begun. In Case III. secretion of free HCl remained absent even after a three weeks' use of the acid in large doses, but was detected in traces three weeks subsequent to the beginning of daily lavage with antacids. It then gradually increased in amount under the morning stomach washing and 1- to 2-drachm doses of dilute HCl after meals, until 0.07 to 0.59 per cent. was reached. Under no subsequent treatment has it been possible to increase this amount.

Cases I. and III. derived no immediate subjective benefit from the use of HCl, while its secretion as free acid was absent from the stomach. When, however, it began to appear in traces in the lifted contents after the test meal, immediate relief was always felt from symptoms of indigestion by its employment in full doses. In these two cases a series of experiments* demonstrated that the immediate amelioration in symptoms of indigestion occurring was in all likelihood due to the ability of the administered acid to perceptibly increase

* See "A Consideration of some Modern Therapeutic Agents in the Treatment of Diseases of the Stomach,"—*THERAPEUTIC GAZETTE*, February, 1893.

the very low percentage of free acid secreted to one at which peptonization could more rapidly advance. Benefit was also not improbably due to the stimulating power of HCl over pepsin formation,—to the transformation of inactive propepsin into the active enzyme ; for apparently only thus could be explained the fact that after the use of this acid at the time of the trial meal, the digestion test with the filtrate from the lifted contents, which in previous examinations when acid had not been taken, was negative, now resulted positively.

In neither of these two cases was the administration of pepsin indicated. In Case II., however, absolutely no improvement resulted from the use of HCl alone, without pepsin. In this case, in which secretion of HCl was in abeyance throughout the period of medical treatment, except for a very brief time, response to tests for bound as well as free HCl being absent on all save one occasion, several trials were made of HCl as a remedy taken after meals, both without pepsin and again combined with it. The results were invariably that symptoms of indigestion were either unrelieved or aggravated by the acid when prescribed without pepsin and apparently always assuaged by the use of the combination. That the benefit could not be due to pepsin alone, as naturally would not be supposed, was shown by its subsequent trial without HCl being totally without effect.

The only reason apparent for the utility of the combination, in presence of the failure of acid alone, is that, as in this case* secretion

* Representing a class in which, with totally absent HCl from the gastric secretion, the use of HCl as a digestant must be almost or totally without effect.

of HCl was suspended, and the percentage of total acidity, representing organic acids and acid salts, was usually low, pepsin formation, through the aid of acids, did not occur even after the administration of HCl; digestion was not, therefore, favored. For it is an established fact that in cases of mucous catarrh without complete atrophy of the tubules, in which HCl secretion is in abeyance, formation of active pepsin no longer occurs from its ever-present potential enzyme,—propepsin. The latter may exist in no small quantity in the mucous membrane, incapable of activity through lack of the presence of adequate amounts of HCl or another acid to aid in its transformation. In these cases of total HCl anacidity, sufficient HCl cannot be administered medicinally after even a moderate meal to both saturate the organic bases, salts, and albuminoids of the food present and materially aid also in the formation of pepsin. But the employment of both pepsin and acid, provided considerable doses are taken, and the amount of food to be disposed of is not excessive, permits digestion to proceed—though imperfectly at best—by aid of the artificial gastric juice, the organic acids present also assisting in peptonization.

It must be stated that in Case II. papoid—a preparation from the *Carica papaya* plant—was also tried. It was taken continuously for a month, at first alone and subsequently combined with beta-naphthol, the latter being added to influence fermentation, originating constant annoying flatulence. Subjective improvement was more decided on papoid, when taken in doses of 5 grains and over, than with pepsin and acid. Relief from symptoms of in-

digestion were immediate, marked, and continuous during the period in which papoid was used. Subsequently, on its cessation, the patient immediately lapsed into her former condition, without any improvement having occurred in the secretory function of the stomach at the end of the thirty days' trial, as shown by the tests then made. The combination of papoid and naphthol seemed of somewhat more benefit than did the use of papoid alone, less flatulency occurring under the employment of the two. Naphthol had been previously tried when strychnine was also taken, in the early part of the treatment, but, without papoid, it was of no apparent utility.

Strychnine, in doses of $\frac{1}{20}$ grain, was employed for a number of weeks in Cases I. and II., but apparently without any effect whatever. For a time, as well, infusion of quassia and calumba were also taken, with soda and acids, alternately.

The remedy of most signal benefit, both for immediate and permanent subjective and objective effect upon the symptoms and their underlying cause, was the intragastric application of electricity. In all the cases faradism and galvanism, and combined galvano-faradization, were employed as follows: The sessions in each case were daily* of from twelve to twenty min-

* My experience with the medical use of electricity—a somewhat large one—has demonstrated conclusively to my mind that failure often attends its application to the amelioration of ailments which, in the nature of things, would be susceptible of relief, or perhaps cure, by the intelligent use of the battery, were sittings more frequent, such as once or twice daily, at least in the early part of treatment. It seems extraordinary that results can be

utes' duration. The stomach was first washed, if food or much mucus was supposed to be present. A half to two-thirds of a pint of water were then taken, and the electrode swallowed. The intragastric electrode employed was the small sized, so called "deglutible" electrode* devised by Dr. Einhorn, of New York, and made for me by Mr. Otto Flemming, of this city. This is beyond doubt the most practicable of the various stomach electrodes suggested, and should always be selected in preference to all others for general use. When its perfect simplicity of application, without more than trifling annoyance to the patient unaccustomed to the tube, is more generally understood, and the benefit that may be derived from intragastric electricity in certain forms of diseases of the stomach is also known, this promising

expected in the treatment of chronic ailments other than perhaps the relief of a myalgia or the exercise of a parietic small muscle group, from a few minutes' application of a current every two, three, or four days. Yet such is the technique of many who use electricity in medicine, and whose results, if *results* are obtained, accrue rather through psychical influence than from any actual direct effect of electricity.

* For a description of this electrode and mode of application, see my chapter on the treatment of chronic gastric catarrh ("System of Practical Therapeutics," edited by Hare, vol. ii. p. 925). Mr. Flemming now joins the electrode to a somewhat stout rubber cord insulating the rheophore. This enables it to be introduced into the stomach without more than one effort at deglutition, and does not necessitate the coincident ingestion of water to aid its passage into the stomach. See, also, Einhorn's interesting papers on the subject (*Medical Record*, May 9, 1891, January 30, February 6, 1892; *New York Medical Journal*, July 8, 1893).

method of treatment will probably come into more general use.

A felt pad formed the indifferent electrode. This was placed upon the epigastrium or another portion of the abdomen. The current was applied for some four to five minutes with the patient sitting, then for ten to fifteen minutes while in recumbency, alternately supine and upon the left side, to bring the current's influence, by aid of the water ingested, to all portions of the gastric parietes, and especially to those parts in which the chief secreting structure resides. When applications were made at the office, an equal portion of each electrical session was given to faradism and galvanism—a few moments each to anode and cathode—and to galvano-faradization. The strength of faradic current employed was one that could be comfortably borne; the same was the case with the galvanic, which latter, however, was always accurately measured, and lay between ten and twenty milliamperes. Case I. received the combined current daily for three weeks and then every third day, using faradism daily at home. Applications were continued daily for three months. They were then discontinued on subsidence of all symptoms and re-begun and continued for a week or so at intervals when electricity seemed indicated from revival of symptoms.

Case II. received the combined method daily during the whole course of six weeks' electrical treatment. A similar method was pursued with Case III., at first on alternate days and then every third to fourth day, she using faradism daily at home, the whole being continued for nine and a half weeks.

In Case I. the percentage of free HCl present before electricity was begun lay between 0.01 and 0.05, the latter never being exceeded. From these figures, without other treatment than the intragastric application of electricity, —lavage, of course, being continued,—it rose in three weeks to 0.1 and in six weeks more to 0.14, about which figure it has since stood, except during periods in which, either from indiscretion in diet, inattention to bowels, or a lack of exercise in fresh air, the general health temporarily declined. The intragastric application of electricity apparently excited a markedly bracing effect upon the general condition, as well as upon the mere local disturbance in the stomach. A sensation of vigor was imparted by its use lasting several hours, and, under it, slight headaches, which had persisted for months, totally disappeared.

Case II., when electricity was begun, I had viewed as almost hopeless regarding improvement to be expected in impaired gastric secretory or motor power, hitherto unyielding to lavage, HCl, strychnine, and other approved remedies. She, however, reacted to the battery in a manner surprising indeed. Totally without other medication, save for a time laxatives, aggravated symptoms of indigestion disappeared entirely and more completely than under any drug hitherto used. Electricity was discontinued after six weeks' daily use. Improvement had been maintained when seen a month after this,* though no drugs had been

* The date of this writing — August, 1893. I am now experimenting with the use of HCl administered in large doses before meals, in this case and in Case III., hoping

taken. Several tests of the gastric secretion showed free HCl always present, and in very nearly normal amount. The bowels, which had become regular before electricity was stopped, continue so, and the stomach completely empties itself between five and six hours after a moderate dinner. All of which shows quite extraordinary improvement from the condition previously existing of HCl anacidity and of marked motor atony with stagnation of the ingesta in the stomach.

Case III. displayed no improvement in secretory power under electricity, the percentage of free acid—0.07 to 0.09, the figures reached on starting with the battery—being maintained but not exceeded. Improvement in the motor function was, however, more decided than under the use of lavage, strychnine, and HCl. After a few weeks' treatment by intragastric electricity, the stomach was invariably found empty in six hours after a mid-day dinner, when, formerly, at the expiration of from seven to eight hours, it still contained remnants of food. Epigastric heaviness and other symptoms occurring after meals, indicating imperfect gastric digestion, previously only relieved by the use of HCl, soon disappeared under the employment of intragastric electricity, no HCl being then required. As no visible improvement in secretory power occurred under electricity, the amelioration in symptoms of indigestion was evidently due to improvement in gastric motor tone, obviating undue retention of food in the stomach.

not only to maintain but to continue to improve secretory activity by this means. A report of the success obtained will be made in the paper preparing on the rational employment of HCl in diseases of the stomach.

It is of interest to note that in these three cases no reaction for HCl could be obtained from the fluid removed from the stomach at the expiration of a half-hour, after ten minutes' application either of faradism alone or of galvanic faradization, though in two of them a fair percentage of free HCl was present in the lifted contents after the trial meal at the time this test was made. This showed in these cases no immediate stimulating effect of electricity on the secretory function, and is contrary to results obtained by Einhorn.

In conclusion, a study of these cases, in which gastric catarrh was present in aggravated form, and in the two least promising of which the most decided improvement occurred, indicates that in the treatment of this ailment lavage is of service as a cleanser of the mucosa and as a stimulant to the most important of the gastric functions,—the secretory and motor; but that in all effects save the first, lavage is decidedly inferior as a remedy to the intragastric application of electricity; that HCl, administered even in full doses after meals, is of less permanent benefit as a stimulant to its own secretion than for its immediate use as a digestant, and that it may be of little utility in this capacity with total absence of this acid from the gastric secretion; then, however, benefit may occur from its use in large doses combined with pepsin. Finally, that of the various remedies employed in the treatment of gastric catarrh for their influence on secretion and motility, none are comparable with the intelligent daily use of intragastric faradism and galvanism.

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